

PSMN1R8-30PL

N-channel 30 V, 1.8 mΩ logic level MOSFET in TO-220

Rev. 02 — 2 November 2010

Product data sheet

1. Product profile

1.1 General description

Logic level N-channel MOSFET in TO-220 package qualified to 175 °C. This product is designed and qualified for use in a wide range of industrial, communications and domestic equipment.

1.2 Features and benefits

- High efficiency due to low switching and conduction losses
- Suitable for logic level gate drive sources

1.3 Applications

- DC-to-DC converters
- Motor control
- Load switching
- Server power supplies

1.4 Quick reference data

Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|--|--|-----|-----|-----|--------|
| V_{DS} | drain-source voltage | $T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$ | - | - | 30 | V |
| I_D | drain current | $T_{mb} = 25\text{ °C}$; $V_{GS} = 10\text{ V}$; see Figure 1 | [1] | - | 100 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}$; see Figure 2 | - | - | 270 | W |
| T_j | junction temperature | | -55 | - | 175 | °C |
| Static characteristics | | | | | | |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$; see Figure 13 ; see Figure 12 | [2] | - | 1.6 | 1.8 mΩ |
| Dynamic characteristics | | | | | | |
| Q_{GD} | gate-drain charge | $V_{GS} = 4.5\text{ V}$; $I_D = 25\text{ A}$; | - | 22 | - | nC |
| $Q_{G(tot)}$ | total gate charge | $V_{DS} = 15\text{ V}$; see Figure 14 ; see Figure 15 | - | 83 | - | nC |
| Avalanche ruggedness | | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $V_{GS} = 10\text{ V}$; $T_{j(init)} = 25\text{ °C}$; $I_D = 100\text{ A}$; $V_{sup} \leq 30\text{ V}$; $R_{GS} = 50\text{ Ω}$; unclamped | - | - | 1.1 | J |

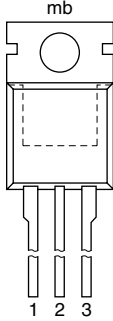
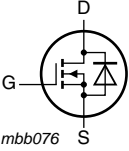
[1] Continuous current is limited by package.

[2] Measured 3 mm from package.



2. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-----------------------------------|---|---|
| 1 | G | gate |  |  |
| 2 | D | drain | | |
| 3 | S | source | | |
| mb | D | mounting base; connected to drain | | |

SOT78 (TO-220AB)

3. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|--------------|----------|--|---------|
| | Name | Description | Version |
| PSMN1R8-30PL | TO-220AB | plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB | SOT78 |

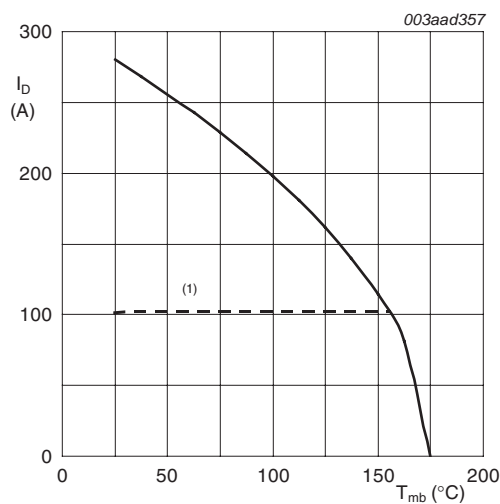
4. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

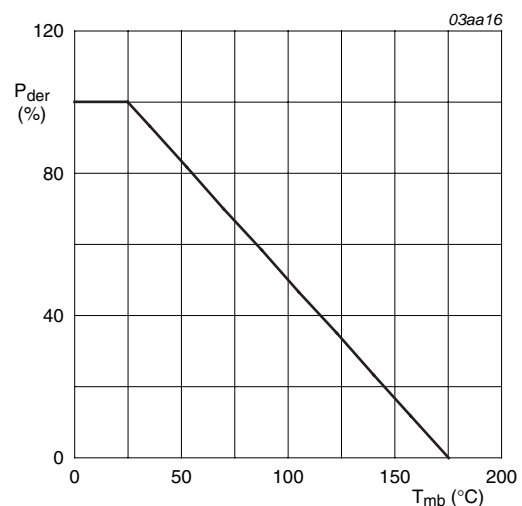
| Symbol | Parameter | Conditions | Min | Max | Unit | |
|----------------------|--|--|---------------------|------|------|---|
| V _{DS} | drain-source voltage | T _j ≥ 25 °C; T _j ≤ 175 °C | - | 30 | V | |
| V _{DGR} | drain-gate voltage | T _j ≥ 25 °C; T _j ≤ 175 °C; R _{GS} = 20 kΩ | - | 30 | V | |
| V _{GS} | gate-source voltage | | -20 | 20 | V | |
| I _D | drain current | V _{GS} = 10 V; T _{mb} = 100 °C; see Figure 1 | [1] | - | 100 | A |
| | | V _{GS} = 10 V; T _{mb} = 25 °C; see Figure 1 | [1] | - | 100 | A |
| I _{DM} | peak drain current | pulsed; t _p ≤ 10 μs; T _{mb} = 25 °C; see Figure 3 | - | 1120 | A | |
| P _{tot} | total power dissipation | T _{mb} = 25 °C; see Figure 2 | - | 270 | W | |
| T _{stg} | storage temperature | | -55 | 175 | °C | |
| T _j | junction temperature | | -55 | 175 | °C | |
| Source-drain diode | | | | | | |
| I _S | source current | T _{mb} = 25 °C | [1] | - | 100 | A |
| I _{SM} | peak source current | pulsed; t _p ≤ 10 μs; T _{mb} = 25 °C | - | 1120 | A | |
| Avalanche ruggedness | | | | | | |
| E _{DS(AL)S} | non-repetitive drain-source avalanche energy | V _{GS} = 10 V; T _{j(init)} = 25 °C; I _D = 100 A; V _{sup} ≤ 30 V; R _{GS} = 50 Ω; unclamped | - | 1.1 | J | |

[1] Continuous current is limited by package.



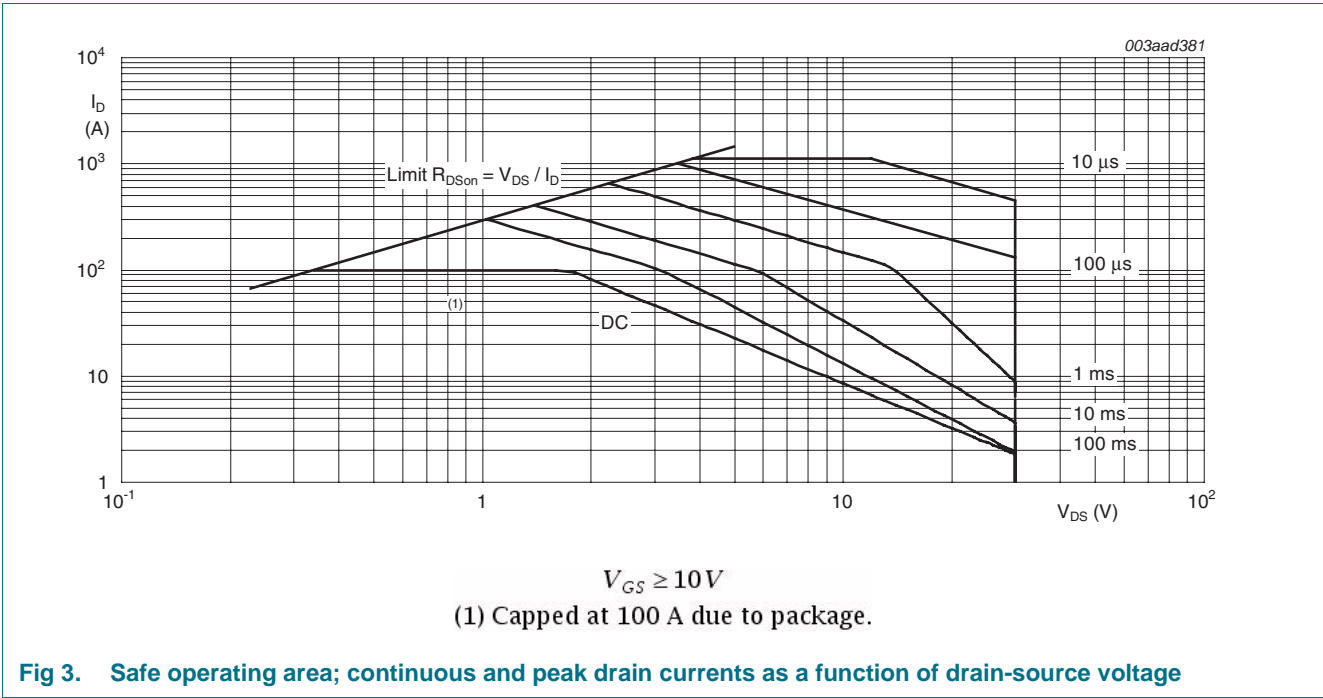
$V_{GS} \geq 10\text{ V}$
(1) Capped at 100 A due to package.

Fig 1. Continuous drain current as a function of mounting base temperature



$$P_{der} = \frac{P_{tot}}{P_{tot(25\text{ °C})}} \times 100\%$$

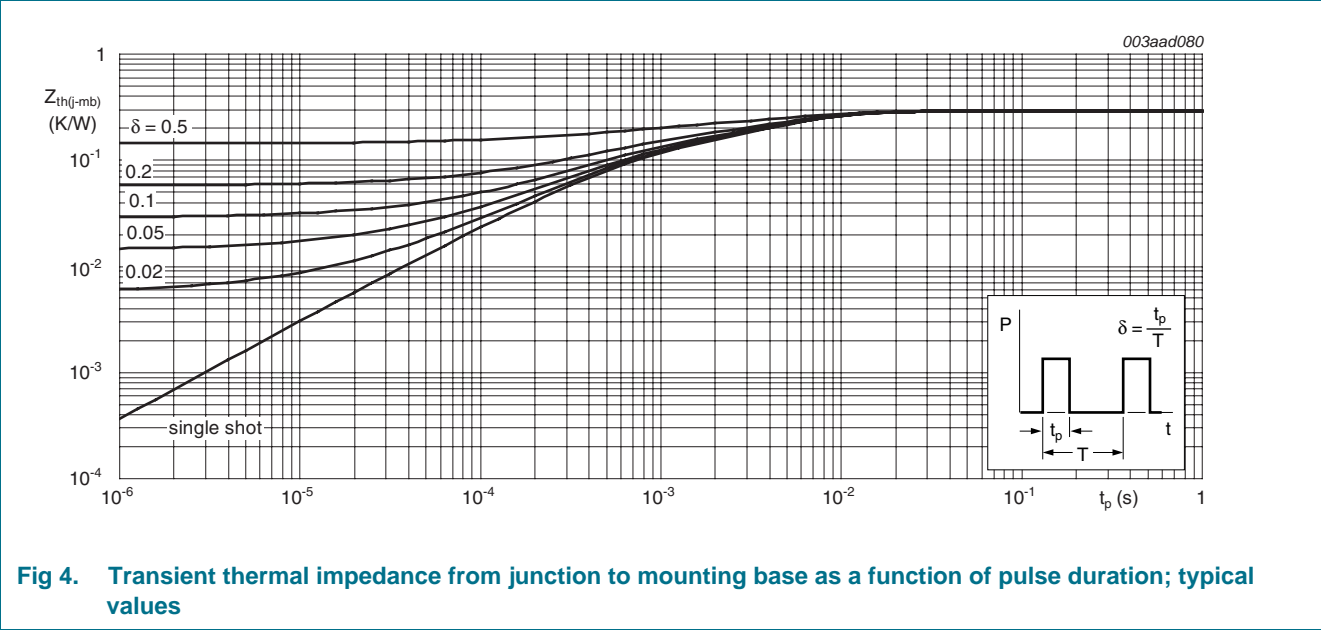
Fig 2. Normalized total power dissipation as a function of mounting base temperature



5. Thermal characteristics

Table 5. Thermal characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------|---|------------------------------|-----|-----|------|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | see Figure 4 | - | 0.3 | 0.56 | K/W |



6. Characteristics

Table 6. Characteristics

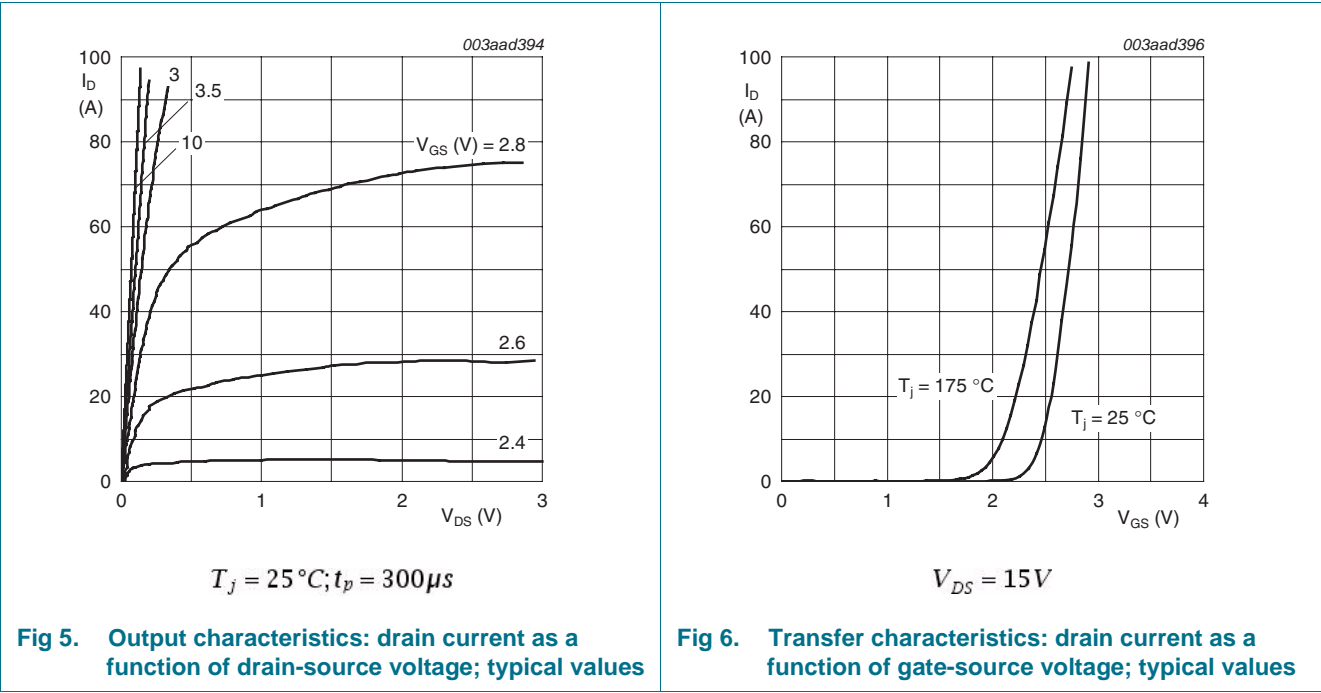
Tested to JEDEC standards where applicable.

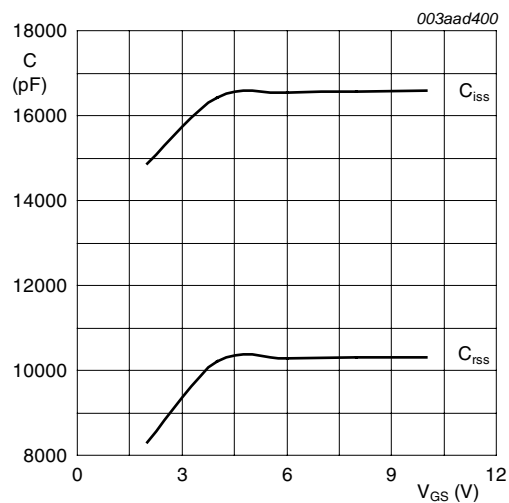
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|-----------------------------------|---|------------------|-------|------|---------------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 250\ \mu\text{A}$; $V_{GS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$ | 30 | - | - | V |
| | | $I_D = 250\ \mu\text{A}$; $V_{GS} = 0\ \text{V}$; $T_j = -55\ ^\circ\text{C}$ | 27 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D = 1\ \text{mA}$; $V_{DS} = V_{GS}$; $T_j = 25\ ^\circ\text{C}$; see Figure 10 ; see Figure 11 | 1.3 | 1.7 | 2.15 | V |
| | | $I_D = 1\ \text{mA}$; $V_{DS} = V_{GS}$; $T_j = 175\ ^\circ\text{C}$; see Figure 11 | 0.5 | - | - | V |
| | | $I_D = 1\ \text{mA}$; $V_{DS} = V_{GS}$; $T_j = -55\ ^\circ\text{C}$; see Figure 11 | - | - | 2.45 | V |
| I_{DSS} | drain leakage current | $V_{DS} = 30\ \text{V}$; $V_{GS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$ | - | 0.3 | 4 | μA |
| | | $V_{DS} = 30\ \text{V}$; $V_{GS} = 0\ \text{V}$; $T_j = 125\ ^\circ\text{C}$ | - | - | 200 | μA |
| I_{GSS} | gate leakage current | $V_{GS} = 16\ \text{V}$; $V_{DS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$ | - | 10 | 100 | nA |
| | | $V_{GS} = -16\ \text{V}$; $V_{DS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$ | - | 10 | 100 | nA |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 4.5\ \text{V}$; $I_D = 25\ \text{A}$; $T_j = 25\ ^\circ\text{C}$; see Figure 12 | - | 1.8 | 2.3 | mΩ |
| | | $V_{GS} = 10\ \text{V}$; $I_D = 25\ \text{A}$; $T_j = 175\ ^\circ\text{C}$; see Figure 13 | - | - | 3.42 | mΩ |
| | | $V_{GS} = 10\ \text{V}$; $I_D = 25\ \text{A}$; $T_j = 100\ ^\circ\text{C}$; see Figure 13 | - | - | 2.4 | mΩ |
| | | $V_{GS} = 4.5\ \text{V}$; $I_D = 25\ \text{A}$; $T_j = 175\ ^\circ\text{C}$; see Figure 13 | - | - | 4.73 | mΩ |
| | | $V_{GS} = 10\ \text{V}$; $I_D = 25\ \text{A}$; $T_j = 25\ ^\circ\text{C}$; see Figure 13 ; see Figure 12 | ^[1] - | 1.6 | 1.8 | mΩ |
| R_G | gate resistance | $f = 1\ \text{MHz}$ | - | 1 | - | Ω |
| Dynamic characteristics | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D = 25\ \text{A}$; $V_{DS} = 15\ \text{V}$; $V_{GS} = 10\ \text{V}$; see Figure 14 ; see Figure 15 | - | 170 | - | nC |
| | | $I_D = 0\ \text{A}$; $V_{DS} = 0\ \text{V}$; $V_{GS} = 10\ \text{V}$ | - | 158 | - | nC |
| | | $I_D = 25\ \text{A}$; $V_{DS} = 15\ \text{V}$; $V_{GS} = 4.5\ \text{V}$; see Figure 14 ; see Figure 15 | - | 83 | - | nC |
| Q_{GS} | gate-source charge | | - | 29 | - | nC |
| $Q_{GS(th)}$ | pre-threshold gate-source charge | | - | 17 | - | nC |
| $Q_{GS(th-pl)}$ | post-threshold gate-source charge | | - | 12 | - | nC |
| Q_{GD} | gate-drain charge | | - | 22 | - | nC |
| $V_{GS(pl)}$ | gate-source plateau voltage | $V_{DS} = 15\ \text{V}$; see Figure 14 ; see Figure 15 | - | 2.6 | - | V |
| C_{iss} | input capacitance | $V_{DS} = 12\ \text{V}$; $V_{GS} = 0\ \text{V}$; $f = 1\ \text{MHz}$; $T_j = 25\ ^\circ\text{C}$; see Figure 16 | - | 10180 | - | pF |
| C_{oss} | output capacitance | | - | 2000 | - | pF |
| C_{rss} | reverse transfer capacitance | | - | 872 | - | pF |

Table 6. Characteristics ...continued
Tested to JEDEC standards where applicable.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------------|-----------------------|---|-----|-----|-----|------|
| t _{d(on)} | turn-on delay time | V _{DS} = 12 V; R _L = 0.5 Ω; V _{GS} = 4.5 V; R _{G(ext)} = 4.7 Ω | - | 92 | - | ns |
| t _r | rise time | | - | 156 | - | ns |
| t _{d(off)} | turn-off delay time | | - | 135 | - | ns |
| t _f | fall time | | - | 69 | - | ns |
| Source-drain diode | | | | | | |
| V _{SD} | source-drain voltage | I _S = 25 A; V _{GS} = 0 V; T _j = 25 °C; see Figure 17 | - | 0.7 | 1.2 | V |
| t _{rr} | reverse recovery time | I _S = 30 A; dI _S /dt = -100 A/μs; | - | 64 | - | ns |
| Q _r | recovered charge | V _{GS} = 0 V; V _{DS} = 12 V | - | 60 | - | nC |

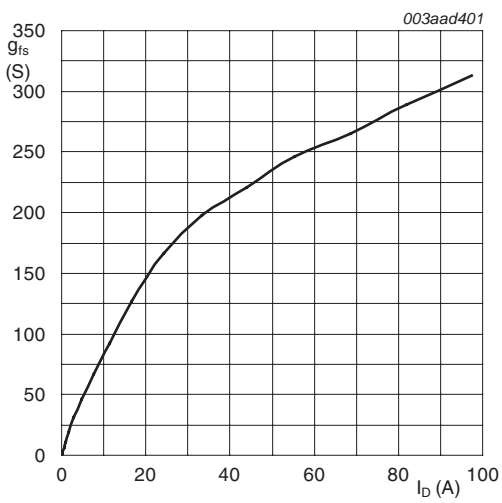
[1] Measured 3 mm from package.





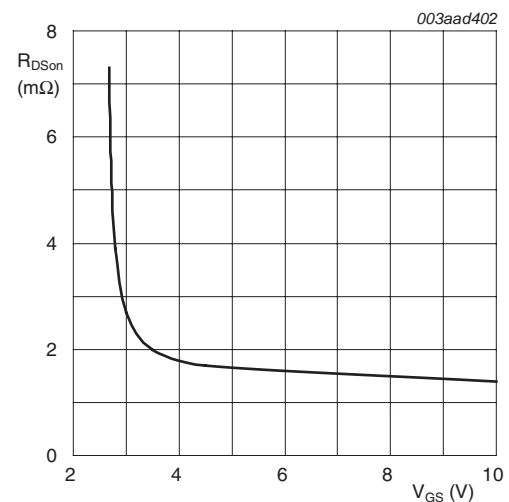
$V_{DS} = 0V; f = 1MHz$

Fig 7. Input and reverse transfer capacitances as a function of gate-source voltage; typical values



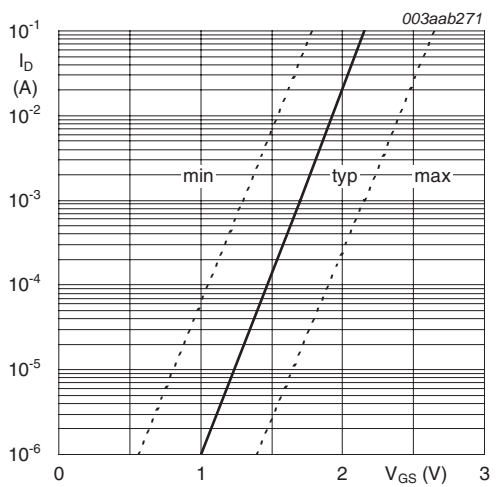
$T_j = 25^\circ C; V_{DS} = 15V$

Fig 8. Forward transconductance as a function of drain current; typical values



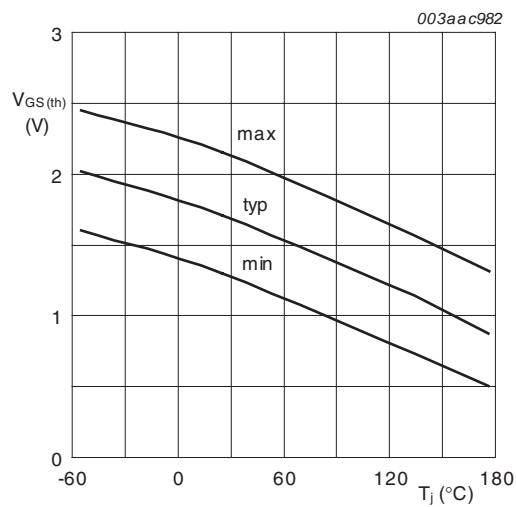
$T_j = 25^\circ C; I_D = 25A$

Fig 9. Drain-source on-state resistance as a function of gate-source voltage; typical values



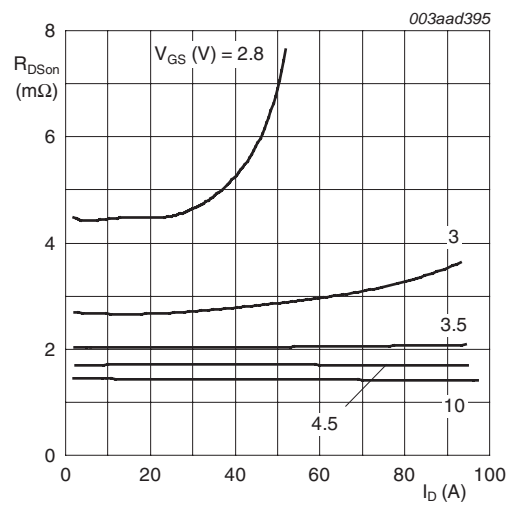
$T_j = 25^\circ C; V_{DS} = 5V$

Fig 10. Sub-threshold drain current as a function of gate-source voltage



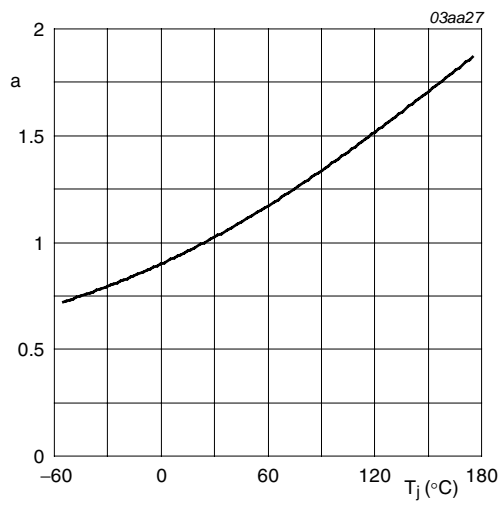
$I_D = 1\text{mA}; V_{DS} = V_{GS}$

Fig 11. Gate-source threshold voltage as a function of junction temperature



$T_j = 25\text{ }^{\circ}\text{C}; t_p = 300\mu\text{s}$

Fig 12. Drain-source on-state resistance as a function of drain current; typical values



$$a = \frac{R_{DS(on)}}{R_{DS(on)25^{\circ}\text{C}}}$$

Fig 13. Normalized drain-source on-state resistance factor as a function of junction temperature

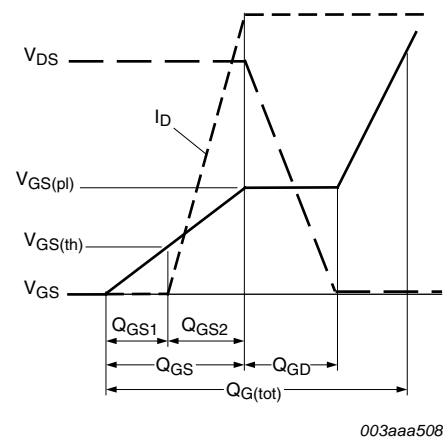
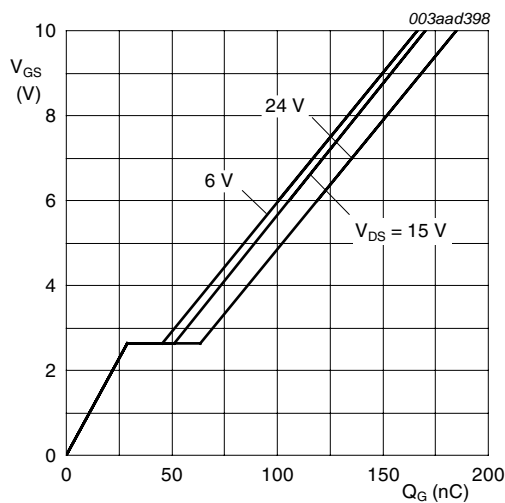
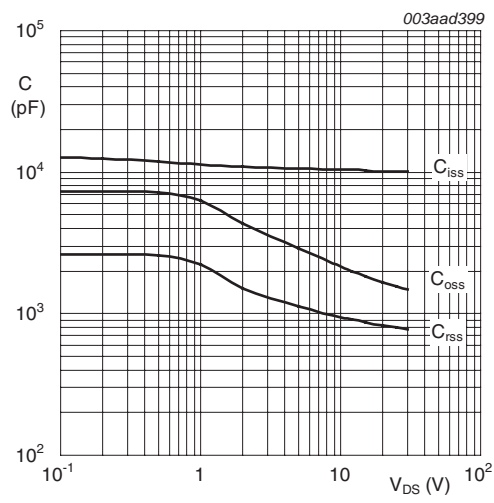


Fig 14. Gate charge waveform definitions



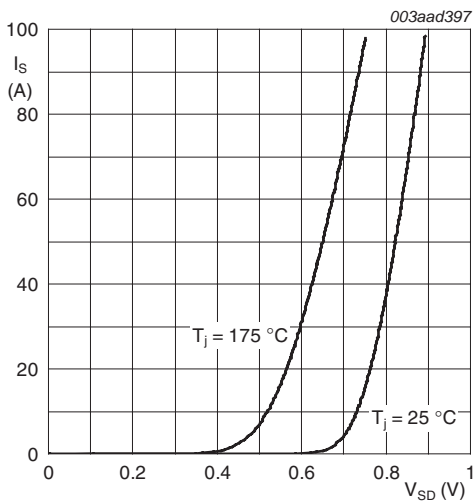
$T_j = 25^\circ\text{C}; I_D = 25\text{ A}$

Fig 15. Gate-source voltage as a function of gate charge; typical values



$V_{GS} = 0\text{ V}; f = 1\text{ MHz}$

Fig 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



$V_{GS} = 0\text{ V}$

Fig 17. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

7. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB SOT78

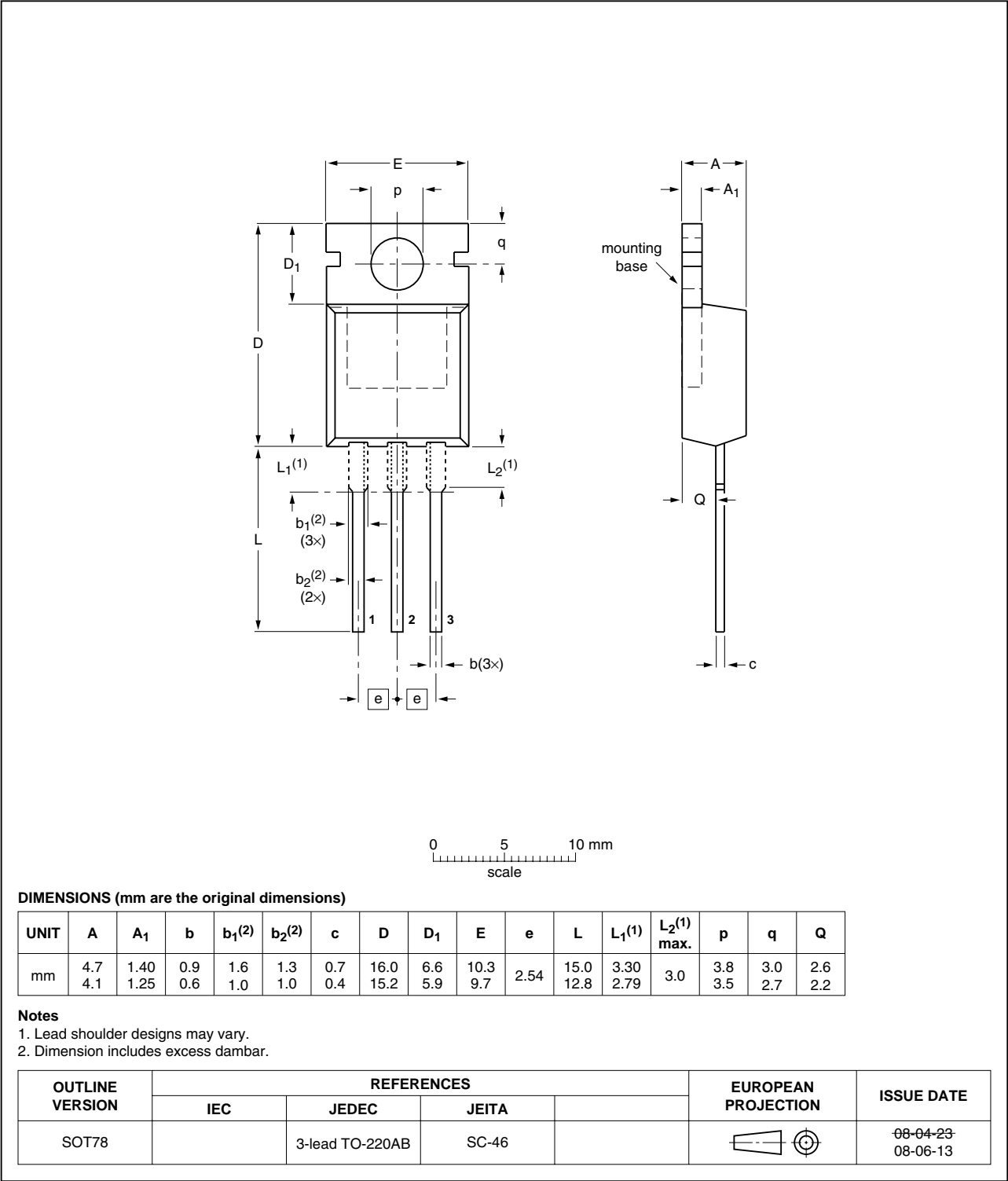


Fig 18. Package outline SOT78 (TO-220AB)

8. Revision history

Table 7. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|------------------|---|----------------------|---------------|------------------|
| PSMN1R8-30PL v.2 | 20101102 | Product data sheet | - | PSMN1R8-30PL v.1 |
| Modifications: | <ul style="list-style-type: none">• Status changed from objective to product.• Various changes to content. | | | |
| PSMN1R8-30PL v.1 | 20100218 | Objective data sheet | - | - |

9. Legal information

9.1 Data sheet status

| Document status ^{[1][2]} | Product status ^[3] | Definition |
|-----------------------------------|-------------------------------|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
| Product [short] data sheet | Production | This document contains the product specification. |

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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11. Contents

| | | |
|-----------|--|-----------|
| 1 | Product profile | 1 |
| 1.1 | General description | 1 |
| 1.2 | Features and benefits | 1 |
| 1.3 | Applications | 1 |
| 1.4 | Quick reference data | 1 |
| 2 | Pinning information | 2 |
| 3 | Ordering information | 2 |
| 4 | Limiting values | 3 |
| 5 | Thermal characteristics | 5 |
| 6 | Characteristics | 6 |
| 7 | Package outline | 11 |
| 8 | Revision history | 12 |
| 9 | Legal information | 13 |
| 9.1 | Data sheet status | 13 |
| 9.2 | Definitions | 13 |
| 9.3 | Disclaimers | 13 |
| 9.4 | Trademarks | 14 |
| 10 | Contact information | 14 |

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